AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

LISTING OF THE CLAIMS:

Claim 1 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

the center point (S) of a regular N-polygonal figure to be determined is set as a fixed point;

a point, which is distant by a certain length from the said center point (S) and revolves around the center point (S), is set as a first point (E);

a point, which is distant by a certain length from the first point (E) and revolves around the first point (E), is set as a second point (M); and

assuming that the second point (M) revolves around the first point (E) at an angular velocity ω, that the first point (E) revolves around the center point (S) at an angular velocity $(1-N)\omega$, that the first point (E) is away from the center point (S) by a distance (r), and that the second point (M) is away from the first point (E) by a distance $(N-1)^2r$, the locus of the second point (M) defines a contour of a regular N-polygonal figure to be determined being circumscribed on a circle having a radius N(N-2)r; and

boring a hole having a shape defined by the contour of the regular N-polygonal figure;

the contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function f(θ) is a periodic function with a period 2 π /N;

the function f(θ) has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 2 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

a regular (N-1)-polygonal figure revolves along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r, and rotates at an angular velocity ω ;

a contour of the said regular (N-1)-polygonal figure is inscribed on a circle having a radius $(N-1)^2r$;

the regular (N-1)-polygonal figure revolves at an angular velocity $(1-N)\omega$; and

an area being swept by the said regular (N-1)-polygonal figure defines a regular N-polygonal figure to be determined, which figure is circumscribed on a circle having a radius N(N-2)r; and

boring a hole having a shape defined by the the regular N-polygonal figure:

the contour of the regular N-polygonal figure can be defined by a function f(θ);

the function f(θ) is a one-valued function;

the function f(θ) is a periodic function with a period 2 π /N;

the function f(θ) has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 3 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

a regular (N+1)-polygonal figure revolves along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r, and rotates at an angular velocity ω ;

a contour of the said regular (N+1)-polygonal figure is inscribed on a circle having a radius $(N+1)^2$r;

the regular (N+1)-polygonal figure revolves at an angular velocity (N+1) ω ;

an area being swept by the said regular (N+1)-polygonal figure defines a regular N-polygonal figure to be determined, which figure is circumscribed on a circle having a radius N(N+2)r; and

boring a hole having a shape defined by the regular N-polygonal figure:

the contour of the regular N-polygonal figure can be defined by a function f(θ);

the function f(θ) is a one-valued function;

the function f(θ) is a periodic function with a period 2 π /N;

the function f(θ) has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 4 (Currently Amended): A method for determining a figure for a regular N-polygonal figure for a boring hole comprises steps for:

setting a fixed center point;

setting a first point which is away from the center point by a certain length and revolves around the center point;

setting a second point which is away from the first point by a certain length and revolves around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity $(1\text{-}N)\omega$ at which the first point revolves around the center point;

setting a distance between the first point and the center point as a distance r;

setting a ratio of the distance between the center point and the first point to the length of a line segment connecting the first and second points being smaller than $(N\text{-}1)^2$; and

defining a figure to be determined by the locus of the second point, which figure has vertexes of N in number, is circumscribed on a circle having a radius N(N-2)r, and is a single closed region formed by curves; and

boring a hole having a shape defined by the figure:

a contour of the regular N-polygonal figure can be defined by a function f(θ);

the function f(θ) is a one-valued function;

the function f(θ) is a periodic function with a period 2π /N;

the function f(θ) has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 5 (Canceled).

Claim 6 (Currently Amended): An apparatus for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

setting a center point of a regular N-polygonal figure to be determined as a fixed point;

setting a first point which is away from the center point by a certain length and revolves around the center point;

setting a second point which is away from the first point by a certain length and revolves around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity $(1\text{-}N)\omega$ at which the first point revolves around the center point;

setting a distance r between the first point and the center point; and

setting a distance $(N\text{-}1)^2 r$ between the second point and the first point: and that

the said control means is constructed so as to carry out functions for defining a regular N-polygonal figure to be determined by the locus of the second point, which figure is circumscribed on a circle having a radius N(N-2)r; and

boring a hole having a shape defined by the regular N-polygonal figure:

a contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 7 (Currently Amended): An apparatus for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

inputting so as to revolve a regular (N-1)-polygonal figure along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r;

inputting so as to rotate such the regular (N-1)-polygonal figure at an angular velocity ω;

setting the regular (N-1)-polygonal figure so as to define a contour which is inscribed on a circle having a radius $(N-1)^2 r$; and

setting an angular velocity $(1-N)\omega$ at which the regular (N-1)-polygonal figure revolves: and that

the said control means is constructed to carry out a function for defining a regular N-polygonal figure to be determined, which is circumscribed on a circle having a radius N(N-2)r, by an area being swept by the regular (N-1)-polygonal figure; and

boring a hole having a shape defined by the regular N-polygonal figure;

a contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 8 (Currently Amended): An apparatus for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

inputting so as to revolve a regular (N+1)-polygonal figure along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r;

inputting so as to rotate such the regular (N+1)-polygonal figure at an angular velocity ω;

setting the regular (N+1)-polygonal figure so as to define a contour which is inscribed on a circle having a radius $(N+1)^2r$; and

setting an angular velocity $(N+1)\omega$ at which the regular (N+1)-polygonal figure revolves: and that

the said control means is constructed to carry out a function for defining a regular N-polygonal figure to be determined, which is circumscribed on a circle having a radius N(N+2)r, by an area being swept by the regular (N+1)-polygonal figure; and

boring a hole having a shape defined by the regular N-polygonal figure:

the contour of the regular N-polygonal figure can be defined by a function f(θ);

the function f(θ) is a one-valued function;

the function f(θ) is a periodic function with a period 2 π /N;

the function f(θ) has one maximum value and one minimum value in one period,

the function f(θ) has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function f(θ); and

the function f(θ) has a positive curvature or no curvature.

Claim 9 (Currently Amended): An apparatus for determining a figure for a boring hole, characterized in that the said apparatus includes an input means and a control means, the said input means is constructed to carry out functions for:

setting a center point as a fixed point;

setting a first point which is away from the center point by a certain length and revolves around the center point;

setting a second point which is away from the first point by a certain length and revolves around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity (1-N)ω at which the first point revolves around the center point;

setting a distance r between the first point and the center point;

setting a ratio of the distance between the center point and the first point to the length of a line segment, which connects the first and second points, being smaller than $(N-1)^2$: and

the said control means is constructed to carry out a function for defining a figure to be determined by the locus of the second point, which figure has vertexes of N in number, is circumscribed on a circle having a radius N(N-2)r, and is a single closed region formed by curves; and

boring a hole having a shape defined by the figure;

a contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 10 (Canceled).